REMARKS

Claims 8-11 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 and 2 of Ikeda et al. (U.S. Pat. No. 6,671,025) in view of Shoichi et al. (JP 10039318). Applicants respectfully traverse this rejection because the double patenting rejection is improper. The subject application is a divisional to the cited Ikeda et al. reference, and was filed in response to a Restriction Requirement issued in the parent Ikeda et al. application. Thus, it is improper for the Examiner to use the patent issuing from parent application as a reference against the divisional application (see 35 U.S.C. §121). Withdrawal of the rejection is respectfully requested.

Claims 9 and 11 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Shoichi et al. in view of Yamada et al. Applicants respectfully traverse this rejection, because the cited references, alone or in combination, do not disclose or suggest a projection that has at least the cell thickness adjusting layer and projection patterns formed on the region between pixel regions of the transparent electrode and another projection, without the cell thickness adjusting layer, formed in the pixel region.

As described in claims 9 and 11, the color filter, the transparent electrode, the projection pattern and the vertical alignment film for covering the transparent electrode and the projection pattern are formed on the pixel region of the plate in this order. A light shielding film formed by overlapping the color filters, the transparent electrode, the cell

thickness adjusting layer and the projection pattern is formed on the region between the pixel regions of the plate in this order, as described in claim 9. Claim 11 describes that the light shielding film including the color filters, the transparent electrode, the projection pattern and the cell thickness adjusting layer is formed on the region between the pixel regions of the plate in this order.

In this manner, a projection that includes the cell thickness adjusting layer and the projection pattern is formed on the region between the pixel regions of the transparent electrode, and a projection that includes the projection pattern, but not the cell thickness adjusting layer, is formed on the pixel region of the transparent electrode. As a result, the height of the projection formed in the pixel region (the projection height from the surface of the transparent electrode) is lower than a height of the projection formed in the region between the pixel regions.

Typically, a liquid crystal display device includes a TFT substrate, a color filter (CF) substrate and a liquid crystal layer sealed between the TFT substrate and the CF substrate. In the present invention, by contacting the top end portion of the projection formed in the region between the pixel regions of the CF substrate to the TFT substrate, the thickness of the liquid crystal layer (or cell thickness) can be maintained constant. Since the height of the projection formed in the pixel region is lower than the height of the projection formed in the region between the pixel regions, the top end portion of the projection formed in the pixel region of the CF substrate does not come in contact with the TFT substrate. By means of the

projection formed in the pixel region and the vertical alignment film, an alignment partition is achieved in the present invention.

More specifically, in the case the liquid crystal has a negative dielectric anisotropy, the liquid crystal molecules located near the projection formed in the pixel region are aligned in the direction perpendicular to the surface of the projection. When the voltage is applied between the TFT substrate and the CF substrate, the inclination directions of the liquid crystal molecules sealed between the substrates are determined by the influence of the liquid crystal molecules located near the projection formed in the pixel region, and thus, the liquid molecules are inclined oppositely on both sides of the projection. As a result, the alignment partition can be achieved.

FIG. 4 of Shoichi discloses that the liquid crystal display element comprises a TFT array substrate, a counter substrate and a liquid crystal layer 20. In the counter substrate of Shoichi, the color filters 17R, 17G, 17B (3R, 3G, 3B in FIG. 1), the counter electrode 18 and the alignment film 15 are formed on the pixel region of the transparent substrate 16 (substrate 1 in FIG. 1) in this order. A light shielding film 17K (3K in FIG. 1), the layer spacer formed by overlapping color filters 17R, 17G, 17B (4R, 4G, 4B in FIG. 1), the counter electrode 18 and the alignment film 15 are formed on the region between the pixel regions of the transparent substrate 16 in this order.

Moreover, in the TFT array substrate of Shoichi, the projecting member 10 (member 5 in FIG. 1) is formed over the region between the pixel regions of the transparent

substrate 11 (substrate 2 in FIG. 1). The projecting member 10 comes into contact with the layer spacer of the counter substrate. Thus, Shoichi teaches that the thickness of the liquid crystal layer 20 (a cell thickness) can be maintained constant by means of the layer-spacer and the projecting member 10.

However, a projection is not formed on the pixel region of the counter electrode 18 in Shoichi. Thus, the alignment partition cannot be achieved. Shoichi also does not disclose a projection being formed on the region between pixel regions of the counter electrode 18.

In FIG. 9 of Yamada, it is shown that the plasma addressed liquid crystal display device includes a display cell 20a, a plasma cell 20b and a liquid crystal layer 16. In the display cell 20a, a signal electrode 13 (the transparent electrode), a color filter 12, a column structures 17 and a vertical alignment layer 15a for covering the color filter 12 and the column structures 17 are formed on the glass substrate 11. The column structures 17 are formed over the pixel region (the region which opposes the discharge channel 26) and over the region between the pixel regions (the region which opposes the partition 27) of the signal electrode 13. Thus, in Yamada, the thickness of the liquid crystal layer 16 (the cell thickness) is maintained constant and the alignment partition is achieved by means of the column structures 17.

In Yamada, however, the height of the column structure 17 in the pixel region is the same as a height of the column structure 17 in the region between the pixel regions.

That is, the height of the column structure 17 in the pixel region is the same as the cell thickness. As described in page 29, line 18-page 30, line 25 of the subject specification, if the height of the projection in pixel region is too large, an open area ratio is reduced to then cause reduction in the transmittance of light. In contrast, if the height of the projection in pixel region is too small, the advantage of the alignment partition cannot be achieved. Thus, it is preferable that the height of the projection in pixel region be appropriately set in accordance with the cell thickness. It is preferable that the range of the height of the projection in pixel region be set to 0.2 to 0.8 times the cell thickness, and more preferably it should be set to 0.3 to 0.5 times the cell thickness. Therefore, in Yamada, the transmittance of light is low.

In the present invention, since the height of the projection formed in the pixel region is lower than the height of the projection formed in the region between the pixel regions, the height of the projection formed in the pixel region is smaller than the cell thickness, and thus the reduction in the transmittance of light can be prevented.

Accordingly, Shoichi and Yamada, alone or in combination, do not disclose or suggest that the projections are formed on the pixel region <u>and</u> on the region between the pixel regions of the transparent electrode of the CF substrate, and the height of the projection formed in the pixel region is lower than the height of the projection formed in the region between the pixel regions, as described in claims 9 and 11. Withdrawal of the rejection is respectfully requested.

In the present invention, by providing the projection (the cell thickness adjusting layer and the projection pattern) to maintain the cell thickness constant on the CF substrate side, there are the following advantages. The light shielding film formed by overlapping the color filters is formed under such projection. The color filter is soft. When the projection is formed on the CF substrate side, the shape of the projection turns into the taper shape where the top surface (the surface on the TFT substrate side) is narrow and the bottom surface (the surface on the CF substrate side) is wide. Since an area where the bottom surface of the projection comes into contact with the CF substrate surface is larger than an area where the top surface of the projection comes into contact with the TFT substrate surface when the TFT substrate and the CF substrate are bonded, pressure per unit area which the CF substrate receives from the projection is smaller than pressure per unit area which the TFT substrate receives from the projection. As a result, even if the strong pressure is applied to the substrate, sinking of the projection into the color filter can be prevented.

Moreover, many TFTs and pixel electrodes are typically formed in the TFT substrate, so that yield of fabrication of the TFT substrate is low. By providing the projection on the CF substrate side, reducing yield of fabrication of the TFT substrate can be prevented.

Furthermore, in the case that the projection is formed on the TFT substrate side as in Shoichi, in order to have the projection formed on the TFT substrate side come into contact with the light shielding film formed on the CF substrate side, highly precise position

alignment is needed. On the other hand, in the case the projection is formed on the CF substrate side, highly precise work is unnecessary.

By providing the cell thickness adjusting layer as described in claims 9 and 11, there is the following advantages. If the cell thickness adjusting layer is not provided, the cell thickness is decided by the thickness of the light shielding film formed by overlapping color filters and the thickness of the projection pattern. In the light shielding film, there is the problem (as described in page 49, line 25-page 50, line 5 of the specification) that the leveling of the color filter (the resin) occurs in the second and third overlying layers until the resin is dried, so that the thickness of the second layer color filter and the thickness of the third-layer color filter are reduced than the thickness of the first-layer color filter. In order to solve the problem, increasing the thickness of the color filter can be considered. However (as described in page 42, line 19-page 43, line 11 of the specification) there is an optimum thickness of the liquid crystal layer of every color (every pixel) of the color filters in order to optimize the optical characteristic. In other words, there is an optimum thickness of the color filter of every color (every pixel). Moreover, as described in page 51, lines 13-19 of the specification, if the thickness of the color filter is too thick, fine patterning of the color filter (the resin) becomes difficult, and productivity is lowered since the drying speed is reduced after the resin has been coated. Therefore, it is not preferred that the thickness of the color filter be too thick.

Also, in the projection pattern, as mentioned above, since there is an optimum thickness of the projection pattern in order that the alignment partition be achieved without the reduction in the transmittance of light, it is not preferred that the thickness of the projection pattern be too thick.

In this manner, since there are the optimum thickness of the color filter and the optimum thickness of the projection pattern, it is not preferred that the thickness of the color filter and the thickness of the projection pattern be too thick. As a result, according to the cell thickness, the cell thickness may not be able to hold only by means of the light shielding film and the projection pattern.

As described in claims 9 and 11, since the cell thickness adjusting layer is provided, the cell thickness can be held even if the thickness of the color filter and the thickness of the projection pattern are not too thick. In other words, since the cell thickness adjusting layer is provided, the cell thickness can be held, making the thickness of the color filter and the thickness of the projection pattern into the optimum thickness.

For all of the above reasons, Applicants request reconsideration and allowance of the claimed invention. The Examiner should contact Applicants' undersigned attorney if a telephone conference would expedite prosecution.

Respectfully submitted,

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